

PATENT SPECIFICATION

(11)

1 308 098

DRAWINGS ATTACHED

(19)



1 308 098

- (21) Application No. 30681/71 (22) Filed 30 June 1971
 (44) Complete Specification published 28 Feb. 1973
 (51) International Classification F16J 15/16 // 15/32 15/34 15/44
 (52) Index at acceptance
 F2B 13B2B 13B3B1A 13B3E1 13C1 13C2B 13C2E3A
 13C2G1 13C5 13CX15
 (72) Inventors ANTON FIEDLER
 FOLKER GROHMANN

(54) IMPROVEMENTS IN AND RELATING TO A SEALING DEVICE FOR ROLL NECK BEARINGS

(71) We, VEB WALZLAGERKOMBINAT, formerly known as VEB LEIPZIGER KUGELLAGERFABRIK DKF, a corporation organised under the laws of Eastern Germany, of 18-20 Rudolf-Hartig-Strasse 7152 Bohlitze-Ehrenberg, Germany, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a sealing device for sealing on the roll body side of a roll-neck bearing of back-up rolls and/or work rolls.

Adequate and reliable sealing devices for roll-neck bearings are of great importance in view of the considerable costs resulting from bearing failures; this applies to sliding bearings as well as to the more expensive but nevertheless more and more applied rolling bearings. The duties of such sealing devices are, e.g., to keep coolants and/or rolling lubricants as well as solid contaminants, such as roll scale, out of the bearing, and to control lubricant leakage.

There are known several sealing devices on the roll body side of roll-neck bearings. Usually these consist of a labyrinth seal and an additional sealing element, e.g. a lip-type seal or a shaft-sealing ring, which may be arranged singly or in pairs, where the interspace of a paired arrangement may be used as a grease chamber, or an O-ring, or a compression ring, or a felt seal, or a ring of synthetic material with interrupted sealing surface.

The operational duty of these sealing devices, i.e. perfect closure of the bearing, can only partially be fulfilled. Frequently the entrance of solid contaminants and/or fluids into the bearing cannot be prevented, particularly when the roll stands are subjected to extreme load conditions. The entrance of moisture will cause loss of lubricity of the

lubricant resulting in corrosion of the bearing elements thus reducing the useful life of the bearing. The entrance of roll scale will cause premature failure of the bearings. Uncontrolled lubricant leakage will cause damage to rolling stocks, e.g. failure of strip surfaces.

The present invention may eliminate the deficiencies inherent in the known sealing devices, by an original combination of single sealing elements.

According to the present invention there is provided a sealing device for sealing on the roll body side of a roll-neck bearing of back-up rolls and/or work rolls, the sealing device including a stepped labyrinth ring arranged to contact the roll body, a bearing cap which co-operates with the labyrinth ring to provide a labyrinth seal action, two slidable seal rings mounted for axial movement in the bearing cap and which abut a flat surface of the labyrinth ring and two radially acting parallel shaft sealing rings supported on the bearing cap being in sliding engagement with a cylindrical surface of the labyrinth ring, part of the bearing cap being effective as a baffle plate which co-operates with the labyrinth ring to provide a clearance seal action, wherein an annular interspace between the radially inner slidable seal ring and the radially acting shaft-sealing ring nearest the roll body constitutes a grease chamber, a radially outer surface of the bearing cap is provided with a circumferential collecting groove, a portion of the labyrinth ring acts as a slinger and wherein a radially outer surface of the labyrinth ring in the region arranged to contact the roll body is tapered and is provided with a sealing ring.

A sealing device may therefore be provided which in its assembled state will not use up more sealing space, or at least will not substantially enlarge the space allotted to a known sealing device, and which will

[Price 25p]

not impede the assembly of the sealing device and/or the assembly of the roll-neck bearings, and which will eliminate the entrance of fluid and/or solid contaminants into the bearing, as well as eliminate the uncontrolled lubricant leakage from the bearing.

A labyrinth seal may be provided with the two spring-loaded slide seal rings with uninterrupted sealing surfaces, which are axially mounted in the bearing cap, abutting upon the inner flat surface of a stepped labyrinth ring, which may be coated with a synthetic resin or a resin binder on a flat surface thereof which is arranged to contact the roll body, where the interspace between the outer and inner slide seal ring is pressure-relieved across the guiding surfaces of the slide seal rings and/or by bores in the slide seal rings. The two parallel radial shaft-sealing rings abut upon the radially inner surface of the bearing cap and are slidable on a cylindrical surface of the stepped labyrinth ring. The lips of the shaft-sealing rings are preferably tapered towards the roll body, and the annular space between the inner slide seal ring and the shaft-sealing ring which is nearest the roll body is constructed as a grease chamber and is pressure-relieved by vertical bores in the bearing cap bottom as well as by an opening in the stationary labyrinth part in the lower half of the bearing cap. The bearing cap end face adjacent to the bearing is constructed as a baffle plate and co-acts with the cylindrical surface of the labyrinth ring to provide a clearance seal. The bearing cap may be constructed as an integral part or in two parts, the baffle plate part then being individually manufactured and mounted. The radially outer surface of the bearing cap has a circumferential collecting groove adjacent to the labyrinth. The axially extending parts of the labyrinth co-act with an axially extending projection of the stationary bearing cap to provide a capillary effect therebetween, the interconnection between the axially extending parts of the labyrinth being partially tapered towards the roll body so that the sealing ring provided on the tapered surface, preferably an O-ring, will abut upon the end face of the roll body. Any fluid flowing off the roll body will thus be conveyed on to the tapered surface of the labyrinth ring and slung off by the end face of the tapered part of the labyrinth ring acting as a slinger.

The individual sealing elements, i.e., O-ring, slinger, circumferential collecting groove in the stationary part of the sealing device, stationary labyrinth with capillary action plus outwardly conveying action, two slide seal rings, grease chamber, two shaft-sealing rings, and baffle plate with clearance seal action, are usefully arranged and combined in a very small space, in which manner

the entrance of fluid and/or solid contaminants into the bearing as well as leakage of bearing lubricant onto the rolling stock is made impossible thus completely preventing bearing failure caused by external contaminants and/or lubricant leakage.

Constructional embodiments of the invention will now be described by way of example with reference to the accompanying drawings, wherein:

Fig. 1 is a sectional view of the upper part of a sealing device;

Fig. 2 is a sectional view of the lower part of the sealing device of fig. 1;

Fig. 3 is a sectional view of another embodiment of the lower part of a sealing device, with a bearing cap consisting of two parts.

On a roll neck 4 is seated a stepped labyrinth ring 3 seated with a "sealing" press fit. The flat surface of the labyrinth ring 3 abuts upon an end face of a roll body 1. A radially outer surface of the labyrinth ring 3 is tapered towards the roll body 1. To prevent passage of coolant and/or rolling lubricant as well as of solid contaminants into an interspace between the flat end surface of labyrinth ring 3 and the end face of the roll body 1, which could eventually result in the entrance of fluid and/or solid contaminants into a bearing along the radially inner surface of the labyrinth ring 3, a sealing ring 2, preferably an O-ring, is provided on the tapered outer surface of the labyrinth ring 3. The tapered outer surface effects a sealing abutment of the O-ring upon the end face of the roll body. The flat end surface 17 of the labyrinth ring 3 may be coated with a synthetic resin or a resin binder thus providing an additional sealing element. Furthermore, the tapered outer surface of the labyrinth ring 3 will convey any fluid escaping from the roll body towards the end face of the labyrinth ring 3 facing bearing 12, the end face acting as a slinger. Any fluid which is not slung off will be collected in and finally drained off via a circumferential collecting groove 18 provided in a radially outer surface of a bearing cap 8 adjacent to the labyrinth. Any fluid having entered the labyrinth, e.g. during start-up, of the roll stand, will be prevented from entering further essentially by the capillary action of the narrow axially extending spaces between the labyrinth and bearing cap and will finally be conveyed out of the labyrinth by the tapered part 6 of the labyrinth.

Two spring-loaded slide seal rings 5 and 5' are mounted for axial movement in the bearing cap 8 and press on the inner surface of the stepped labyrinth ring 3. An annular interspace 19 between the slide seal rings 5 and 5' is pressure-relieved across guide surfaces of the slide seal rings and additionally by radial bores 11 in the slide seal rings, Fig.

2. The uninterrupted sealing surfaces of the slide seal rings 5 and 5' are pressed on the labyrinth ring 3 by circumferentially spaced springs 7. Pressure of the slide seal rings 5 and 5' on the labyrinth ring 3 may be varied by changing the preload of the springs 7.

The bearing is further sealed by two parallel radial shaft-sealing rings 9 and 9' which are supported by the bearing cap 8 and are in sliding engagement with the cylindrical surface of the stepped labyrinth ring 3. The lips of the shaft-sealing rings 9 and 9' are tapered preferably towards the roll body 1 to allow leakage of lubricant when the bearing 12 is over-lubricated. Annular inter-space 20 between the radially inner slide seal ring 5' and the shaft-sealing ring 9 is filled with grease and thus serves as a grease chamber. The lower part of the bearing cap 8, fig. 2, has pressure-relieving bores 13 leading into the annular interspace 20 as well as an opening 14 in bearing cap 8 additionally providing pressure-relief to the annular interspace 20.

As can be seen from Figures 1 and 2, the end face of the bearing cap 8 adjacent to the bearing is constructed as a baffle plate 10 and co-acts with the cylindrical surface of the labyrinth ring 3 to provide a clearance seal.

To simplify the manufacture of the bearing cap 8 the baffle plate 10 may be constructed as an individual part, as can be seen from Fig. 3. In that case the baffle plate 10 will be mounted on the bearing cap 8 with several counter-sunk screws, after sealing rings 15 and 15' have been placed into corresponding grooves of the bearing cap 8.

To simplify dismantling of the press-fitted labyrinth ring 3 from the roll neck 4, the labyrinth ring 3 is provided with several axially extending tapped holes 21 in the flat surface adjacent to the bearing 12, where an extracting tool adapted for this purpose may be applied.

WHAT WE CLAIM IS:—

1. A sealing device for sealing on the roll body side of a roll-neck bearing of back-up rolls and/or work rolls, the sealing device including a stepped labyrinth ring arranged to contact the roll body, a bearing cap which co-operates with the labyrinth ring to provide a labyrinth seal action, two slidable seal rings mounted for axial movement in the bearing cap and which abut a flat surface of the labyrinth ring and two radially acting parallel shaft sealing rings supported on the bearing cap being in sliding engagement with a cylindrical surface of the labyrinth ring, part of the bearing cap being effective as a baffle plate which co-operates with the labyrinth ring to provide a clearance seal action, wherein an annular interspace between the radially inner slidable seal ring

and the radially acting shaft-sealing ring nearest the roll body constitutes a grease chamber, a radially outer surface of the bearing cap is provided with a circumferential collecting groove, a portion of the labyrinth ring acts as a slinger and wherein a radially outer surface of the labyrinth ring in the region arranged to contact the roll body is tapered and is provided with a sealing ring.

2. A device as claimed in claim 1, wherein the labyrinth ring is coated with a sealant on a flat surface thereof which is arranged to contact the roll body.

3. A device as claimed in claim 2, wherein the sealant is a synthetic resin or resin binder.

4. A device as claimed in claim 1, 2 or 3, wherein the slidable seal rings are preloaded by compression springs.

5. A device as claimed in any one of claims 1 to 4, wherein the slidable seal rings have uninterrupted sealing surfaces.

6. A device as claimed in any one of claims 1 to 5, wherein an annular interspace between the outer and inner slidable seal rings is pressure-relieved across the guide surfaces of the slidable seal rings and/or through radial bores in the slidable seal rings.

7. A device as claimed in any one of claims 1 to 6, wherein sealing lips of the shaft-sealing rings are tapered towards the roll body.

8. A device as claimed in any one of claims 1 to 7, wherein the annular interspace between the radially inner slidable seal ring and the shaft-sealing ring which is nearest the roll body is pressure-relieved by vertical bores in the bearing cap as well as by an opening in that part of the bearing cap which is the stationary part of the labyrinth.

9. A device as claimed in any one of claims 1 to 8, wherein the bearing cap is constructed in two parts so that one part, i.e. the baffle plate, may be manufactured individually.

10. A device as claimed in any one of claims 1 to 9, where the baffle plate co-acts with the cylindrical surface of the labyrinth ring to provide the clearance seal.

11. A device as claimed in any one of claims 1 to 10, wherein the circumferential collecting groove in the radially outer surface of the bearing cap is provided adjacent to the labyrinth ring.

12. A device as claimed in any one of claims 1 to 11, wherein the axially extending parts of the labyrinth are constructed to have a capillary effect.

13. A device as claimed in any one of claims 1 to 12, wherein the radially outer surface of the labyrinth ring is tapered towards the roll body.

14. A device as claimed in any one of

claims 1 to 13, wherein the sealing ring comprises an O-ring which is sealingly abuts upon the end face of the roll body.

15. A sealing device substantially as described herein with reference to, and as illustrated by, Figures 1 and 2 of the accompanying drawing.

16. A sealing device substantially as hereinbefore described with reference to Figure 3 of the accompanying drawing.

For the Applicants:

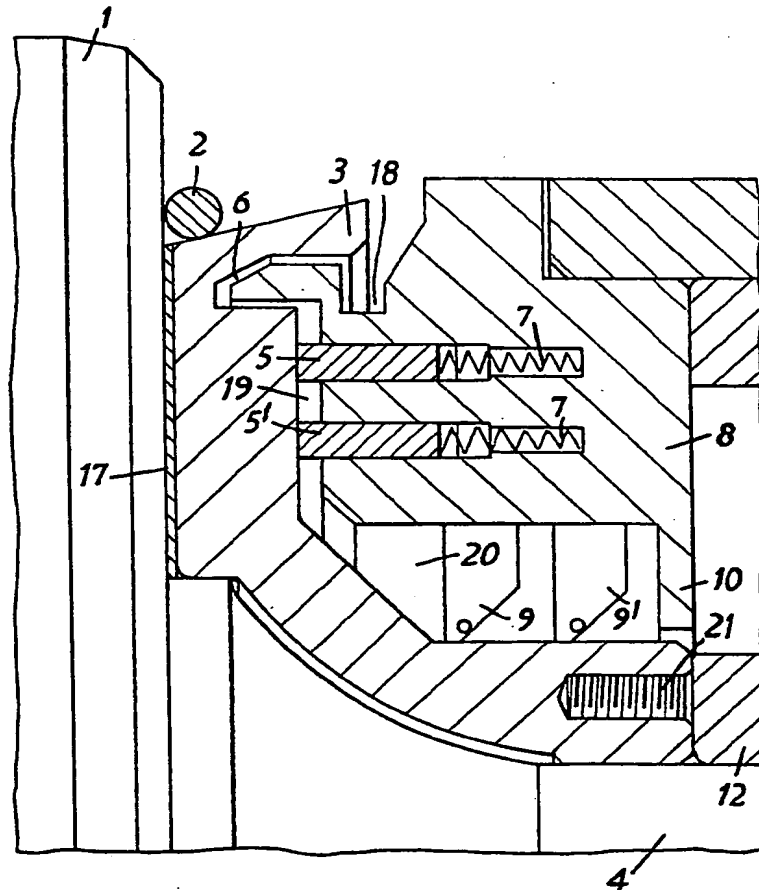
MATTHEWS, HADDAN & CO.,

Chartered Patent Agents,

Haddan House,
33 Elmfield Road,
Bromley, Kent. BR1 1SU.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1973.
Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY from which copies may be obtained.

FIG. 1.



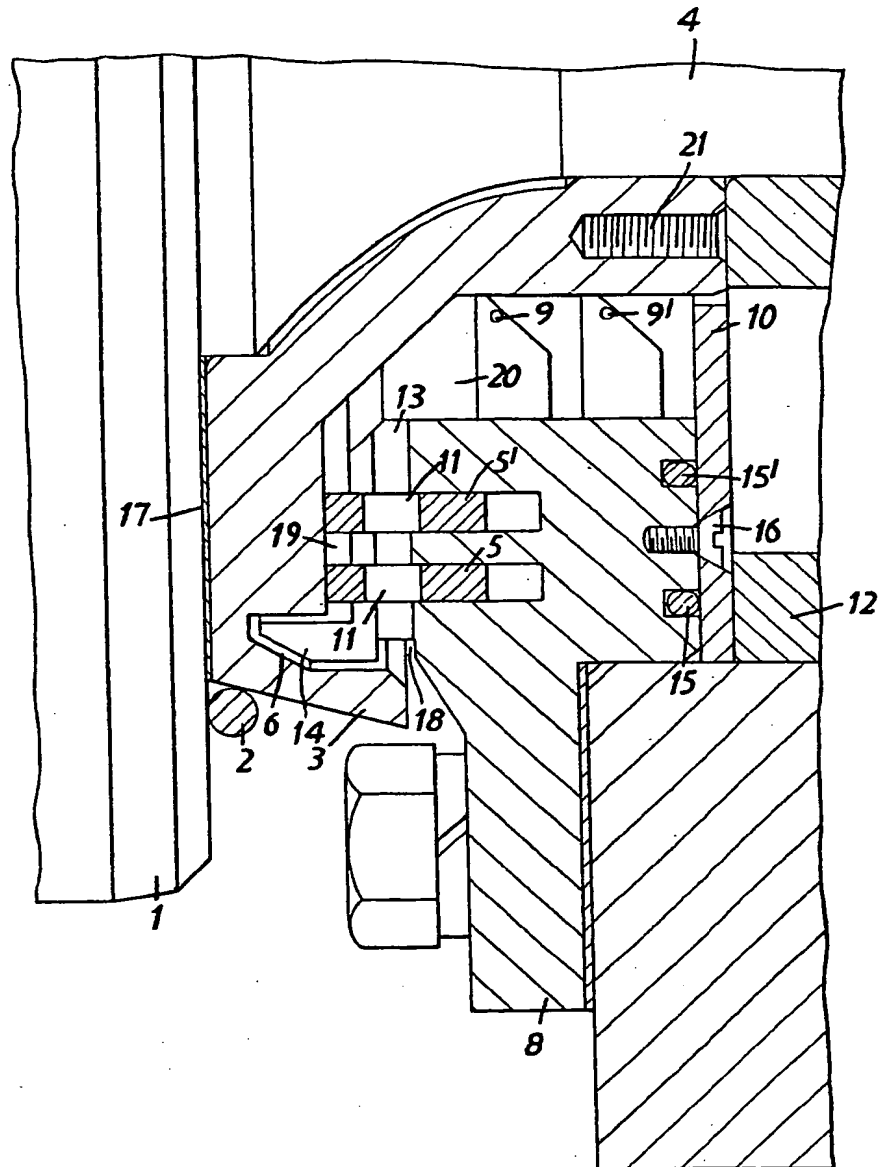
1,308,098

3 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of
the Original on a reduced scale.
SHEET 3

FIG. 3.



THIS PAGE BLANK (USPTO)